# International Workshop on In-Situ Resource Utilization

Cleveland Downtown Hilton Garden Inn

August 15 – 17, 2006

## Monday, August 14th

**4:00 - 8:00 Registration in Lobby near Armington**

## Tuesday, August 15th

**7:00 - 8:30 Registration and Continental Breakfast Outside Edison I and II**

**8:30 - 10:00 Plenary Session 1a, Edison I**

Workshop Opening - Kurt Sacksteder, NASA GRC

Welcome to Cleveland/NASA Glenn Research Center - Stephen Simons, Deputy Chief, Exploration Systems, NASA GRC

Exploration Requirements Synthesis - Frank Schowengardt - NASA HQ

Lunar Architecture Team and Lunar Precursor Robotic Program - Anthony Lavoie - NASA HQ

International Partner Programs in ISRU and Related Areas

**10:00 - 10:30 Break, Outside Edison I and II**

**10:30 - 12:00 Plenary Session 1b**

Lunar Soil Properties - Jeffrey Plescia - APL

NASA ISRU Technology Development Project - Gerald B. Sanders - NASA JSC

Instructions to Workshop Participants - Kurt Sacksteder, NASA GRC

**12:00 - 1:30 Lunch, box lunches available for purchase at registration desk (Please buy tickets before 10:00)**

**1:30 - 3:00 Workshop Topic Session 1a**

| Topic 1) Oxygen Production: Modeling and Hardware Concepts/Trades | Topic 2) Lunar Regolith Excavation for Resource Extraction and Site Preparation | Topic 3) Extraction of Lunar Polar Resources and Solar Wind Volatiles |
|---|---|---|
| Edison I | Johnson (2nd floor) | Edison II |
| William E. Larson - KSC | John Caruso - GRC | Landon Moore - JSC |
| Larry Clark - Lockheed Martin | Leslie Gertsch - University of Missouri, Rolla | Lawrence Taylor - University of Tennessee |
| Edgardo Santiago-Maldonado - KSC, scribe | Diane Linne - GRC, scribe | Julie Kleinhenz - CWRU, scribe |

**3:00 - 3:30 Break, Outside Edison I and II**

**3:30 - 5:30 Workshop Topic Session 1b**

| Topic 1) Oxygen Production: Modeling and Hardware Concepts/Trades Discussion | Topic 2) Lunar Regolith Excavation for Resource Extraction and Site Preparation Discussion | Topic 3) Extraction of Lunar Polar Resources and Solar Wind Volatiles Discussion |
|---|---|---|
| Edison I | Johnson (2nd floor) | Edison II |

**6:00 - 7:00 Welcome Reception, Cash Bar and Hors Douvres, Armington**

Dinner is on your own (consult logistics information for local restaurants)

Hosted by the NASA Glenn Research Center and the National Center for Space Exploration Research

Technical Organizer: Dr. Kurt Sacksteder/GRC, Workshop Coordinator, Christine Gorecki/NCSER

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## Wednesday, August 16th

**7:00 - 8:30 Continental Breakfast Outside Edison I and II**

**8:30 - 10:00 Plenary Session II, Edison I**

Lunar Precursor and Robotic Program, Raymond French - NASA MSFC

Centennial Challenges Program, Kenneth Davidian - NASA HQ

Lunar Regolith Simulant Development Program, Carole McLemore - NASA MSFC

Survey of Facilities for Simulating Lunar Environments, Diane Linne - NASA GRC

**10:00 - 10:30 Break, Outside Edison I and II**

**10:30 - 12:00 Workshop Topic Session 2a**

| Topic 4) ISRU Links with Propulsion and Cryogenic Storage Systems | Topic 5) ISRU Links with Surface Mobility and Power Systems | Topic 6) ISRU Links with Surface Life Support Systems |
|---|---|---|
| Edison I | Johnson (2nd floor) | Edison II |
| Andrew Petro - JSC | Robert Ambrose - JSC | Daniel Barta - JSC |
| David Chato - GRC | Aloysius Hepp - GRC | Tom Simon - JSC |
| TBD, scribe | James Zakrajsek - GRC, scribe | TBD, scribe |

**12:00 - 1:30 Workshop Lunch, Great American Grill, buffet**

**1:30 - 3:30 Workshop Topic Session 2b**

| Topic 4) ISRU Links with Propulsion and Cryogenic Storage Systems Discussion | Topic 5) ISRU Links with Surface Mobility and Power Systems Discussion | Topic 6) ISRU Links with Surface Life Support Systems Discussion |
|---|---|---|
| Edison I | Johnson (2nd floor) | Edison II |

**3:30 - 4:00 Break, Outside Edison I and II**

**4:00 - 5:30 Workshop Topic Session 3a**

| Topic 7) Integrating Lunar Excavation, Oxygen Production and Polar Resources into LPRP, Sortie and Outpost Missions | Topic 8) Excavation, Traction, and Granular Flow: Modeling and Measurements | Topic 9) ISRU Links to Lunar Science Objectives and Instruments |
|---|---|---|
| Edison I | Johnson (2nd floor) | Edison II |
| Jerry Sanders - JSC | Allen Wilkinson - GRC | Jeff Taylor - University of Hawaii |
| Robert Easter - JPL | Philip T. Metzger - KSC | Paul Spudis - APL |
| Raymond French - MSFC, scribe | Philip T. Metzger - KSC, scribe | David Ercegovic - GRC, scribe |

**6:00 - 7:00 Informal Discussion (Cash Bar, hors d'oeuvres) Outside Edison I and II**

**7:00 - 8:30 Workshop Banquet Edison I, Speaker: Professor Jeff Taylor - University Hawai'i**

**Topic, "Science, ISRU and Commerce - the Three Pillars of Space Settlement"**

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## Thursday, August 17th

**7:00 - 8:00 Continental Breakfast Outside Edison I and II**

**8:00 - 10:00 Workshop Topic Session 3b**

| Topic 7) Integrating Lunar Excavation, Oxygen Production and Polar Resources into LPRP, Sortie and Outpost Missions Discussion | Topic 8) Excavation, Traction, and Granular Flow: Modeling and Measurements Discussion | Topic 9) ISRU Links to Lunar Science Objectives and Instruments Discussion |
|---|---|---|
| Edison I | Johnson (2nd floor) | Edison II |

**10:00 - 10:30 Break, Outside Edison I and II**

**10:30 - 12:30 Workshop Topic Session 4 a,b**

| Topic 10) Integrating Lunar ISRU-Based Manufacturing, Construction and Self-Sufficiency into Preparations for Long-Term Lunar and Mars Exploration | Topic 11) Lunar Environmental Effects on Exploration Systems | Topic 12) ISRU and Development of a Space Economy |
|---|---|---|
| Edison I | Johnson (2nd floor) | Edison II |
| Carole McLemore - MSFC | Paul Greenberg - GRC | Robert Wegeng - NASA HQ |
| Rob Mueller - KSC | Phil Abel - GRC | Michael Duke - Emeritus |
| TBC, scribe | Paula Dempsey - GRC, scribe | Kurt Sacksteder - GRC, scribe |

**12:30 - 2:00 Lunch, box lunches are available for purchase at registration desk (Please buy tickets by 10:00 on Tuesday)**

**2:00 - 5:30 Workshop Topic Reports, Edison I**

Topic 1) Oxygen Production: Modeling and Hardware Concepts/Trades

Topic 2) Lunar Regolith Excavation for Resource Extraction and Site Preparation

Topic 3) Extraction of Lunar Polar Resources and Solar Wind Volatiles

Topic 4) ISRU Links with Propulsion and Cryogenic Storage Systems

Topic 5) ISRU Links with Surface Mobility and Power Systems

Topic 6) ISRU Links with Surface Life Support Systems

Topic 7) Integrating Lunar Excavation, Oxygen Production and Polar Resources into LPRP, Sortie and Outpost Missions

Topic 8) Excavation, Traction, and Granular Flow: Modeling and Measurements

Topic 9) ISRU Links to Lunar Science Objectives and Instruments

Topic 10) Integrating Lunar ISRU-Based Manufacturing, Construction and Self-Sufficiency into Preparations for Long-Term Lunar and Mars Exploration

Topic 11) Lunar Environmental Effects on Exploration Systems

Topic 12) ISRU and Development of a Space Economy

Workshop Wrapup Summary, Jerry Sanders - JSC

**5:30 Workshop Concludes**

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